TELEPHONE ENGINEER

MANAGEMENT • ENGINEERING • MAINTENANCE

AUGUST 1937

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Telephone Exhibit at Great Lakes Exposition, Cleveland

Stromberg-Carlson
1191 Handset

Ringer, Induction Coil and
Condenser are mounted in
the base of the instrument.

WINNING ON MERIT » » »

Once a person uses a Stromberg-Carlson 1191 Handset, he is never satisfied with any other instrument. That makes it easier to sell new subscribers or extension telephone service. And it's small wonder that subscribers are pleased with the equipment the operating company supplies when that equipment is the Stromberg-Carlson 1191 Handset.

It is self-contained, with ringer, induction coil and condenser being mounted in the base of the instrument. This does away with the unsightly bell box.

The transmitter applies the cone-shaped diaphragm of the radio speaker, with the diaphragm moving as a rigid unit in a piston-like motion. Maximum flexibility, insuring greater movement with the same effort, is obtained by the use of annular corrugations near the outer edge. The result is a clarity of articulation undreamed of previously.

The receiver sets new standards of efficiency through the scientific proportioning of the magnetic circuits and the Stromberg-Carlson method of clamping the diaphragm which permits assembling and testing before threading into the handle.

If you will order a sample of the Stromberg-Carlson 1191 Handset and test it under your most exacting requirements, you will see how it will build business for you.

STROMBERG-CARLSON TELEPHONE MANUFACTURING CO.
FACTORY AND GENERAL OFFICES: 100 CARLSON ROAD, ROCHESTER, N. Y., U. S. A.
BRANCH OFFICES: CHICAGO KANSAS CITY, SAN FRANCISCO, TORONTO

Stromberg-Carlson

MAKERS OF VOICE TRANSMISSION AND VOICE RECEPTION APPARATUS FOR MORE THAN FORTY YEARS

Published Monthly by **Telephone Engineer Publishing Company.**
A magazine devoted to the interests of the entire telephone industry —operating men and manufacturers.

TELEPHONE ENGINEER

MANAGEMENT • ENGINEERING • MAINTENANCE

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Palaver

Things are happening around the offices of the U. S. Independent Telephone Association these days. Preparations for the annual convention to be held on October 12-15 are rapidly taking shape. President John H. Agee is back from an extended European tour. Exhibitors are demanding more space than in former years. It looks like 1937 is heading for one of the best years of association history.

▼

Things are humming around our office, too. Preparations for our ANNUAL CONVENTION NUMBER are also being completed. If Louis Pitcher can take the August heat, so can we. So be on the lookout for our September number. It will have detailed information on what our advertisers are exhibiting. Many new products are to be introduced. Besides the wonderful program being arranged by those in charge, the exhibits promise to be worth the trip to any telephone man in the United States, Maine and Vermont included!

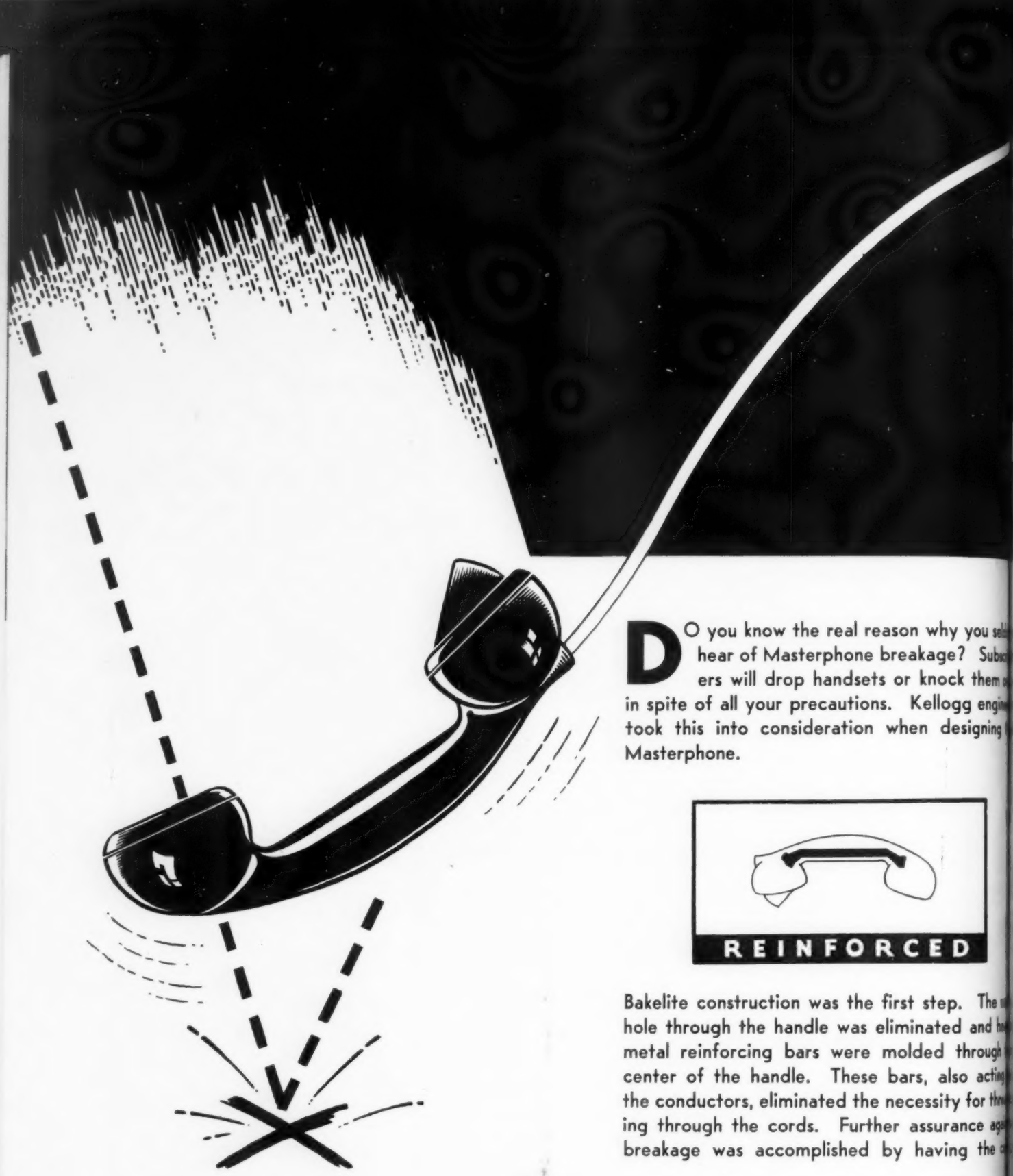
▼

Ellison, our cartoonist, swears his rib tickler carried in these columns this month is an actual experience. Standing on his constitutional rights, he refuses to divulge who experienced it. We reserve opinion!

▼

Speaking editorially, we hope every reader will turn to our editorial page for discussion on the hearing instigated by the REA before the Iowa Commerce Commission endeavoring to have that body rescind their ruling on inductive interference passed in 1916.

RAMBLER II



DO you know the real reason why you sel
hear of Masterphone breakage? Subsc
ers will drop handsets or knock them o
in spite of all your precautions. Kellogg engin
took this into consideration when designing
Masterphone.

Bakelite construction was the first step. The
hole through the handle was eliminated and he
metal reinforcing bars were molded through
center of the handle. These bars, also acting
the conductors, eliminated the necessity for thr
ing through the cords. Further assurance aga
breakage was accomplished by having the

"e find the Eveready Air Cell dependable, convenient
nd by far the most economical battery we have used".

"The 'Air Cell' has given us a source of constant peak transmission with minimum amount of attention".

"We purchased them for a try-out ... they have proved the most economical and convenient batteries we have used".

"Eveready Air Cells are economical and service is good to the last".

"They require scarcely any attention".

"We have every reason to believe they will continue to give 'peak' transmission over 6,000 hours".

"The batteries have proved satisfactory in every way".

TRIBUTE!

From all over we're getting the same enthusiastic response from companies who have installed "Eveready" "Air Cell" Operator's Transmitter Batteries. When exacting exchange managers write like this they must have something to write *about*. Have *you* investigated this finest of all sources of battery power for magneto exchanges? Your telephone jobber can tell you more . . . or write us.

NATIONAL CARBON COMPANY, Inc.
GENERAL OFFICES: NEW YORK, N. Y.
BRANCHES: CHICAGO, SAN FRANCISCO

Unit of Union Carbide UCC and Carbon Corporation

The words "Eveready" and "Air Cell" are trade marks of National Carbon Co.

Editorial « « «

Shall REA Override Jurisdiction of State Commissions?

One of the most regrettable results of the current controversy between the telephone industry and the Federal Rural Electrification Administration over allocation of expense involved in coordinating existing telephone circuits and new electric power circuits is the apparent effort of REA to destroy the jurisdiction of State Commissions over such matters.

Jurisdiction of almost all State Commissions is determined and provided for by law. In many cases this jurisdiction includes the authority to grant franchises and to establish conditions under which franchises shall be granted and exercised. Under this authority numerous State Commissions have adopted rules regulating construction of power transmission lines and providing for coordination of these power lines with existing communication lines. Furthermore, in some cases, the rules require those electric companies constructing lines which cause interference on existing communication lines to negotiate and make a financial settlement with communication companies in eliminating the interference.

Commissions' rules have been found to be fair and just and private electric companies and telephone companies have, over a long period of time, abided by the rules and have amicably settled their inductive coordination problems.

Now, after all these years during which power and telephone companies have adjusted their differences under Commissions' rules, comes REA claiming that State Commissions should not have jurisdiction over the conditions under which franchises shall be granted and should not have the authority to make rules pertaining to financial settlements between communication companies and telephone companies for the elimination of electrical interference from their lines.

In fact, in the hearing before the Iowa Commerce Commission this month, REA attorneys held that the Iowa Commission DID NOT have this jurisdiction and demand that the Commission rescind its order of December 30, 1916, which among other things, provides that power companies make equitable settlement with communication companies before starting construction of power circuits.

It would seem that REA's stand is away out of line. State Commissions receive their authority and jurisdiction by legislature mandates and they are charged with the responsibility and duty to effect rules, regulations and policies that will adequately and justly protect all interests within their states. There is no reason why those policies should not apply to REA cooperatives as well as any other organizations desiring to operate within the respective states.

In its endeavor to override the jurisdiction and authority of State Commissions, it seems to us that REA has employed unfair and questionable methods to persuade the Commissions to meet its demand. There was a veiled threat in the Iowa hearing to the effect that further Federal funds to construct rural power lines *might* not be forthcoming to that state if the Commission's order of December 30, 1916, is not adjusted or rescinded to allow REA to come and go as it likes without regard to property and rights of others. These threats should be considered "blows below the belt". They certainly have no place in any discussion leading toward amicable agreements between REA cooperatives and the telephone industry.

We appreciate the position in which Commissions might find themselves under this pressure from Washington, but judging by their past performance it is not expected that they will be influenced one bit by these threats in the carrying out of their responsibility and duty. It is certain that they will not allow the rights and property of others to be violated or destroyed simply because a Federal Agency requests that it be permitted to do so.

TELEPHONE ENGINEER
MANAGEMENT • ENGINEERING • MAINTENANCE

AUGUST, 1937

"Tapping In" On Washington

By ROLAND C. DAVIES
Editor
Telecommunications Reports

● A sweeping investigation of the Federal Communications Commission and its broadcasting regulatory practices and policies by the Senate, either during the recess of Congress and at the next session, is deemed to be definitely assured.

The approval by the Senate Interstate Commerce Commission of a resolution, calling for the inquiry, which was sponsored by Senator Wallace H. White, Jr., Maine Republican, who is ranking minority member on the committee, came a few days ago in a surprise action. The Administration, it is known, is opposed to the investigation, because of the possible probing of the broadcasting activities of Elliott Roosevelt, the President's son, and of Democratic National Committee officials, including Postmaster General Farley, Emil Hurja and Charles Michelson, the publicity director who just took a publicity post with the nation's highest-powered broadcasting station WLW at Cincinnati.

Whether the prospect of the Senate investigation of the FCC will tend to prevent the submittal of nominations by President Roosevelt for the two vacant FCC Commissionerships, occasioned by the death of Chairman Anning S. Prall and the resignation of Commissioner Irvin Stewart, could not be ascertained at press time of TELEPHONE ENGINEER. But it seemed likely that the President would not transmit any nominations while the investigation resolution was pending, as it would touch off the "spark" for the inquiry's approval. But prior to the White resolution's approval by the Senate committee, the President had told Washington newspapermen that he hoped to send the nominations to Congress before that body's adjournment.

Chairman Wheeler, the energetic Montana Senator, of the Senate Interstate Commerce Committee will preside over the proposed FCC-radio investigation, if it is approved by the Senate. It is understood that the investigation hearings would not get under way until late November or in December, provided the Senate votes for the inquiry. The Interstate Commerce Committee is planning to ask for $25,000 for the inquiry. Present indications are that the main purpose of the Senate investigation will be on the subject of broadcasting regulation, but it is possible that the telephone side of the FCC picture, especially the Telephone Investigation, may be injected into the picture. International communications also is included as part of the resolution's provisions and, while it is mainly confined to the cable and radiotelegraph situation, the overseas radiotelephone service might be taken up to some degree.

● As a hopeful sign of strengthening the prestige of the FCC, the President is known to be searching for the appointment of an outstanding person for the Commission chairmanship. A report that John D. Biggers, president of the country's largest glass company, the Libby-Owens-Ford Co., was being considered for the post definitely backed up that impression of the President's quest for a strong appointment. However, Mr. Biggers is understood to be unobtainable because of his present business duties. Other leading candidates, on a roll of names for the Commissionerships which is daily growing, are First Assistant Postmaster General Howes, and Federal Trade Commissioner Ewin L. Davis. Mr. Davis would make an excellent appointment, it is felt, as he was a leading figure in radio legislation while a member of the House from Tennessee for many years. Labor has a candidate in person of Willard Bliss, who is supported by the CIO union, American Communications Association which is trying to organize the entire broadcasting and communications fields.

The future program of the FCC for next year calls for a number of significant steps, which are of important interest to the telephone industry. One task ahead of the FCC is the transmittal of its report and legislative recommendations to Congress on the results of the two-year Telephone Investigation which was completed last June 30. Several important studies are also being considered

by the FCC, too, including the evolving of the depreciation accounting system and a procedure for the separation of toll and exchange telephone plant.

● For the vacancy, caused by Dr. Stewart's retirement, the President has entertained the idea of a "merit" appointment —the designation of a leading Commission official who has good background and knowledge of communications. Three names during the advance considerations for the FCC vacancies were uppermost as "merit" appointees. They were FCC Chief Engineer T. A. M. Craven, who is rated as one of the leading radio engineers of the country and has achieved a notable record during his FCC service; General Counsel Hampson Gary, who has instituted a number of steps of important reorganization of the FCC's law department and was three years ago a member of the original Commission before Prall was appointed and Carl I. Wheat, Telephone Rate Counsel, who heads the special rate and research department of the Commission and achieved the most tangible accomplishment of the FCC Telephone Investigation last winter when he secured a $12,000,000 annual toll rate reduction from the American Telephone and Telegraph Co.

From the standpoint of telephone industry regulation, Mr. Wheat, who was general counsel of the California Railroad Commission and utlities counsel of the city of Los Angeles for a total of 9 years, is not only excellently grounded in telephone regulation problems but also has a wide knowledge of the industry and its operations. Mr. Wheat also has a reputation of being entirely fair and willing to view all sides of regulatory questions and has achieved many of his results, including the $12,000,000 toll rate reduction, through frank conferences and discussions with telephone company officials. As evidence of the President's desire to secure capable persons for the FCC vacancy, Mr. Wheat's name was given highest consideration even though he is registered Republican and the two vacant FCC posts had been occupied by Democrats. Mr. Wheat's name has also been discussed to become FCC General Counsel in event of the appointment of Mr. Gary to the Commission.

Little Legislation Affecting Telephone Industry . . .

● Outside of the Wages-Hours bill, the current session of Congress is expected to be adjourned with practically no legislation of direct effect upon the telephone industry. The Wages-Hours bill with the prospect of a 40 cent per hour wage and 40-hour week will have little, if any, effect upon the operating costs of telephone companies for labor as the latest Labor Department reports show the telephone industry stands near the top of American industry with a work week around the 40 hour mark and an hourly wage scale of double the minimum proposed in the bills pending before Congress.

Very little legislation has been introduced in the present session which touched upon the telephone industry. The Lea bill to expand the powers of the FCC over free or discount telephone service has apparently been pigeonholed by the House Interstate Commerce Committee after a hearing—this is the second time that this proposal has met such a fate, as the Senate Interstate Commerce Committee a year ago likewise shelved a similar bill. The bill, sponsored by Senator Minton, Indiana New Deal supporter, to establish original cost and prudent investment as the rate base for utilities is now on the Senate calendar but seems to be doomed to remain there and even if the Senate should pass it, House action appears most unlikely. House consideration, too, seems unlikely on the measure to expand the powers of the Federal Trade Commission, which at one time was thought to contain a possibility of dual regulation over the telephone industry by the FCC and FTC. A trio of measures, enlarging the scope of the Securities and Exchange Commission's powers over trust indentures and trusteeships, protective committees and bankruptcy reorganizations likewise appear to have little chance of passage at this session. The Government reorganization proposal of the President, which submerge the administrative activities of Independent commissions like the FCC in an executive department, seems to be utterly consigned to the limbo for this session, although hearings are being held by the Senate committee.

CONVENTION SCHEDULE

The Illinois Telephone Association, Hotel Pere Marquette, Peoria, September 22 and 23.

Independent Pioneer Telephone Association, Hotel Stevens, Chicago, October 14.

United States Independent Telephone Association, Hotel Stevens, Chicago, October 12, 13, 14, and 15.

Broadcast to Feature Independents August 24

Announcement has just been made by United States Independent Telephone Association headquarters that the Farm & Home Hour, featured daily on a nationwide hookup by the National Broadcasting Company will devote a portion of their one hour program August 24 to the independent telephone industry.

Set your dials to your NBC station carrying this hookup for 11:30 a. m. CST on the morning of August 24. Louis Pitcher, executive vice-president of the association will be introduced during the program. The value of this courtesy to the independent telephone industry will be invaluable and it is expected to be heard by an estimated farmer audience of 5,000,000 exclusive of listeners in cities and smaller towns.

Lull in FCC Activities; To Work on Investigation Reports to Congress . . .

● A complete lull in activities due to vacations settled over the FCC during August, but September and October will mean the renewal of considerably speeded up action, it is anticipated. One of the important tasks before the FCC will be the drafting of the reports and legislative recommendations to Congress on the Telephone Investigation. A corps of a dozen Investigation staff experts under the direction of Telephone Division Chairman Paul A. Walker and Investigation Counsel-in-charge Holmes Baldridge was to commence the preliminary formulation of the reports, beginning in mid-August. Of course, until corrections of the exhibits and testimony are received from the American Telephone and Telegraph Co., Bell System companies and Independent industry as stipulated by Chairman Walker up to September 30, the final form of the FCC reports to Congress cannot be compiled. The reports, as drafted in preliminary form by the Investigation staff, will have to run the gauntlet of approval by the Commissioners before they are sanctioned for transmission to Congress next January.

Plan New Direct Radiotelephone Circuits to Europe . . .

● The interesting disclosure by the American Telephone and Telegraph Co. of its plan to establish direct radiotelephone circuits between the United States and four European nations—Germany, Italy, Russia and Switzerland—was made in a hearing before the FCC Telephone Division on July 29 and 30. The program for the new transatlantic service, which will be tested for approximately a

(Please turn to page 32)

Location of Cable Faults

by

C. F. PETERSON

Continuing Mr. Peterson's article on the location of faults in cable plant. We consider this one of the most understandable treatises on location of cable faults we have ever presented---Editor.

PART II

The Three Test Varley Method ●The three test Varley method permits the use of unequal ratio arms, thus enabling the bridge *to be balanced to a fraction of an ohm*, and with this method the resistance of the good wire is not important.

It consists of three separate measurements, the first two of which determine the resistance from bridge to fault.

With the three test Varley, *two good* wires are required. The following procedure should be followed in making fault locations by the three test Varley method.

●Step 1. Select a bad conductor (in case of wet cable) having the heaviest leak to ground, also two good conductors having an insulation resistance of at least 300,000 ohms to ground and to other conductors. These good conductors need not be of the same resistance as the bad wire and *need not even be in the same cable*.

Step 2. Identify and strap together the two good and the bad wires at the first terminal past the section in which the fault is known or thought to exist.

Step 3. (Varley reading No. 1). On the bridge end (usually the office) connect either of the good wires to post (X_1) on the bridge and the other good wire to the (Gr.) post and connect the bad wire to post (X_2). Set ratio arm on 0.1. Balance bridge and call reading of rheostat (R_1). See Figure 5.

Step 4. (Varley reading No. 2). Disconnect the second good wire from the (Gr.) post and connect the ground wire to this post. Leave the ratio arm set on 0.1. Balance the bridge and call this reading (R_2). See Figure 6.

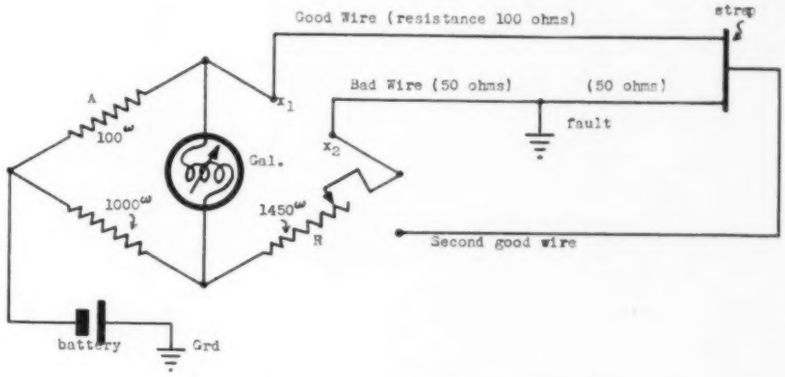


Figure 6—Arrangement for Varley No. 2 Reading

Step 5. Determine the resistance from strap to fault by the following equation:

Where M = Ratio dial setting

X_b = Resistance of bad wire from strap to fault.

R_1 = Reading in ohms obtained in first test.

R_2 = Reading in ohms obtained in second test.

$$Xb = \frac{M}{M+1}(R_2 - R_1)$$

Inasmuch as the ratio dial is usually set on 0.1, the term $\frac{M}{M+1}$ always equals .091 when the ratio dial is on this setting.

●The above equation may be stated as follows: The *resistance of the bad wire from strap to fault* is equal to the reading (R_2) less the reading R_1 multiplied by 0.091 (where ratio dial is set on 0.1).

Step 6. (Varley reading No. 3) The fault location obtained in Step 5 may be checked by an additional test as follows: Connect the (Gr.) post of the bridge to the office end of the bad wire and balance the bridge, call this reading (R_3). See Figure 7. Determined the resistance from bridge to fault by the following equation:

$$\times_a = \frac{M}{M+1}(R_3 - R_2)$$

Where X_a = Resistance of bad wire from bridge to fault.

R_3 = Reading in ohms obtained in Varley Reading No. 3.

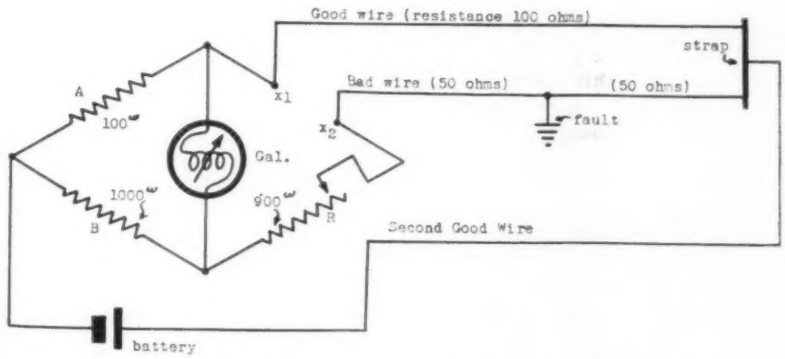


Figure 5—Arrangement for Varley No. 1 Reading

(Please turn to page 28)

Don't Tell Me, Let Me Guess!

Act III of

Showmanship in Business

by

ZENN KAUFMAN

GEORGE M. COHAN, master playwright and producer, used to say that if you didn't have your audience guessing at the end of the first act then your show wasn't worth a plugged nickel. Cohan's judgment has made him a rich man, so let's see if we can't use his formula in our sales methods.

● Mystery books sell big. Any witch's tale will always pull radio audiences. Mystery pictures pack movie houses. Your public loves mystery. Object lesson—give it to them in your sales promotion. Smart merchandisers do. At the Chicago Fair, people stood in line for an hour at Continental Can's Booth to punch a button that would manufacture a tin bank worth a nickel. Inquiry developed the fact that one out of four people on the line *didn't even know what they were waiting for.*

"Can your car sing?" was the legend on small placards that one smart Chevrolet dealer put on the lawns of several hundred homes. These cards were mounted and "planted" with the blank side toward the street. For several days the mystery blossomed—until a crew of house-to-house salesmen started a drive to sell automobile radios. A Woolworth store in Long Beach, California, uses mystery to sell shopworn items. Grab-bags—ranging in price from two to eleven cents are put at the exits of the store and customers are eager to "take a chance". A similar idea is employed —successfully—by a Pennsylvania druggist who repacks his holiday left-overs in gift box packages that give no indication of what is inside, and offers them at prices slightly below their value.

● In Douglas, Arizona, the Mountain States Telephone Company injected an atmosphere of mystery by offering to disclose the "secret workings" of the telephone system to the public. A series of questions: "Did you know that the 'number please' girl on the other end of your telephone rarely speaks loud enough to be heard two feet away?" and "That gold and silver is used in the construction of a telephone?" served to awaken interest in an "open house" held by the company for the people of this community. Interested throngs crowded the company's offices for this chance to get some "inside dope."

Who Killed Cock Robin?

● Crime pays. At least, it pays when you use it as a theme for selling goods. The Eno Crime Club had one of the greatest audiences of any show on the air. The public is *always* interested in a mystery thriller. So you can easily see why it pays to put a mystery angle into your merchandising. One company ran a sales contest based on a G-Man theme. It was called a Search for Missing Sales and each salesman was given a quota of sales to find. A chart on the wall had a string of blank footprints next to each man's name. As a salesman "captured" the missing subscribers, his trail of footprints was colored in red—the first salesman to get to the end of the trail got the prize. This contest was successful because every man is at heart an amateur Hawkshaw. If you scratch the average citizen you usually uncover a man who is—secretly—an amateur sleuth. This contest can also be run among non-selling employees—directing their efforts toward selling to friends, relatives, etc.

Stop
WORRYING AND WONDERING ABOUT THAT OUT-OF-TOWN FRIEND OR RELATIVE
Go
TO HER OR HIM BY TELEPHONE. LOWEST RATES EVERY NIGHT AFTER SEVEN AND ALL DAY SUNDAY

Mystery! The red light instills doubt! Stop! The green light, realization! Go!

● Another contest was based on a "kidnapping" theme. The employees received scribbled messages reading: "You have been picked to do the job. Them that squeals gets croaked!" After this mystery percolated for a few days, the employees received an announcement to the effect that the company was running a campaign for new subscribers and employees were to "kidnap" as many prospects as possible. Of course, the story went on to tell that the "swag" would be divided among the men doing the best "kidnapping" job.

The Reuben Donnelley Company puts mystery into the selling directory advertising. They talk to prospects about the Invisible Market. Invisible! Shades of S. S. Van Dine! What is the Invisible Market? That's what the prospect wonders. Donnelley's salesmen go on to show how the market for most goods is divided into two parts. Visible and Invisible. The Visible market includes known users—prospects—and is covered by direct mail, newspaper and radio advertising. The Invisible Market is made up of emergency buyers, and folks who want to buy but must grope blindly for a place to spend their money. Telephone directory advertising, of course, is the only way to reach them. This story is dramatized effectively in a visual presentation prepared by C. O. Lillyblade, Donnelley's sales manager. Other sections of the book show how directory advertising does a selling job for each kind of business. Thirty-eight sections tell a specialized story for thirty-eight types of prospects and a final section dramatizes a buyer's survey made by the New York Telephone Company among 141,000 buyers to see just how widely the telephone directory was used. 90% of the people interviewed said they consulted the directory for buying information.

● George Graf has introduced mystery to sales meetings by using a "Voice of Experience" speaking over a concealed microphone. At one point in the meeting, the new business manager says that the next feature of the program is not ready—during which time a radio will be turned on. Then out of this radio comes a special sales story fed through a concealed microphone. The "Voice" introduces himself on the air and reads a letter from an employee asking how to handle a certain difficult sales situation. The "Voice" then proceeds to answer the question. This trick-way of presenting training material will double and triple its effectiveness.

Don't Go Too Far

● Mystery excursions are another expression of the public's craving for the unknown. The NEW YORKER tells about a man who lived 140 miles from Washington, drove in one morning to take a mystery excursion on the B. & O. Railroad. The train went back to his home town. (Can you imagine the expression on his face, that night, when his friends ask him where the train had gone!) He was disgusted—naturally—didn't want to return to Washington, but had to get his car and drive another 140 miles back home. This rather nicely illustrates a warning about mystery in general: Don't go too far in teasing your public. Just as the importance of any design must, architecturally, justify its base, so a delayed denouement must be important enough, dramatically, to compensate for the suspense. If your public feels cheated, you are worse off than before you started.

GET THE ANSWER
Quickly BY TELEPHONE
LOWEST RATES EVERY NIGHT AFTER SEVEN AND ALL DAY SUNDAY
WHY HASN'T HE WRITTEN?
DID HE GET THE JOB?
HOW IS MOTHER?
WHEN WILL SHE ARRIVE?
IS DAD BETTER?

More mystery! What's the answer? Your telephone will get them—quick!

M. Zenn Kaufmann

General Has July Gain Over 1935

General Telephone Corporation reports for its subsidiaries a gain of 1,693 company-owned telephones for the month of July, 1937, as compared with a gain of 1,282 telephone for the month of July, 1936. The gain for the first seven months of 1937 total 15, 528 telephones, or 4.64%, as compared with a gain of 11,837 telephones, or 3.79% for the corresponding period of 1936. The subsidiaries now have in operation a total of 350,244 company-owned telephones.

FREE

Have you sent for your copy of The Showmanship Yardstick, yet? You'll find it a valuable check list of 12 showmanship elements vital to the success of any business venture. A self-addressed envelope will bring it to you.

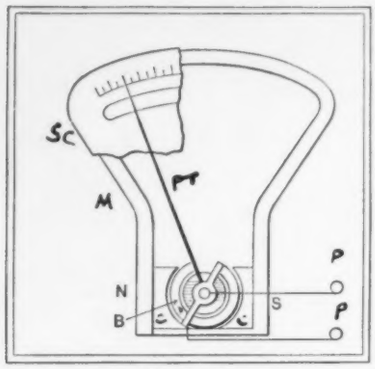


Figure 1

Local Test Desk Operation

By C. F. CURTISS

In this article is discussed some common methods of measuring the three electrical quantities, voltage, current and resistance, which is involved in every telephone circuit

PART III

THE principal instruments used to measure voltage and current in a telephone line circuit are the familiar type of direct current voltmeters and milliammeters commonly used in test desk practices. The prefix "milli" means one thousandth of an ampere. A study of the principle upon which the operation of the voltmeter and milliammeter is based, and how each is placed in a circuit to obtain a desired measurement will now be made.

Voltmeters and milliammeters are very much alike in design and general appearance and operate upon the following principle of electrical science: If a conductor which lies in a magnetic field, at right angles to the direction of the magnetic lines of force, and a current of electricity is caused to flow through the conductor there will be a force (active power) developed which will tend to move it. The amount of the force depends on two things, first, the value of the electric current, and second, the strength of the magnetic field.

If the strength of the magnetic field be kept constant, for example, by means of permanent magnets, the force exerted on the conductor will depend only on the value of the current through it.

●In voltmeters and milliammeters, the deflecting torque (force applied to the moving coil element which causes its rotation) is proportional to the product of the strength of the magnetic field and the value of the electrical current flowing in the movable element.

Several varieties of this type of electrical measuring instruments, have been invented, and those in common use are classified into two types. (1) Those in which the magnet is arranged to move and the coil held stationary, and (2) those in which the magnet is stationary, and the coil is arranged to move. This latter type is the one commonly used in telephone exchanges for testing purposes.

A very accurate moving coil instrument (ammeters and voltmeters) is manufactured by the Weston Electrical Instrument company, and is the kind generally installed on test desks.

These meters consist essentially of an aluminum pointer so designed as to move over a calibrated scale. The pointer is rigidly attached to a rectangular aluminum frame upon which is wound many turns of fine insulated copper wire to form a movable coil. The frame is pivoted top and bottom in jeweled bearings and mounted to rotate in a space between a soft iron core and specially curved iron pole pieces fastened to the ends of a horseshoe shaped permanent steel magnet. The magnetic field produced by the permanent magnet is so intense that the instrument readings are not affected by weak external magnetic fields. The readings may, however, be affected by strong external magnetic fields, and because of this care should be taken not to place the instrument too close to powerful external magnetic fields, such as dynamos, and etc., as the readings may be rendered incorrect, However, no permanent injury would be done to the instrument by being so exposed.

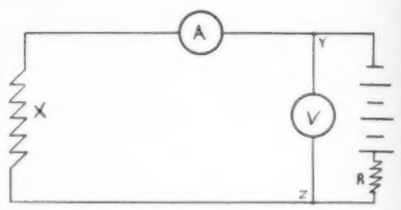


Figure 2

● The electric current is lead into and from the movable coil by means of two spiral springs, which serve to control the coils movement. The controlling torque exerted by these two springs is about proportional to the angle through which the coil is moved, therefore, the angular deflection of the coil and of the pointer in degrees is very nearly

(Please turn to page 22)

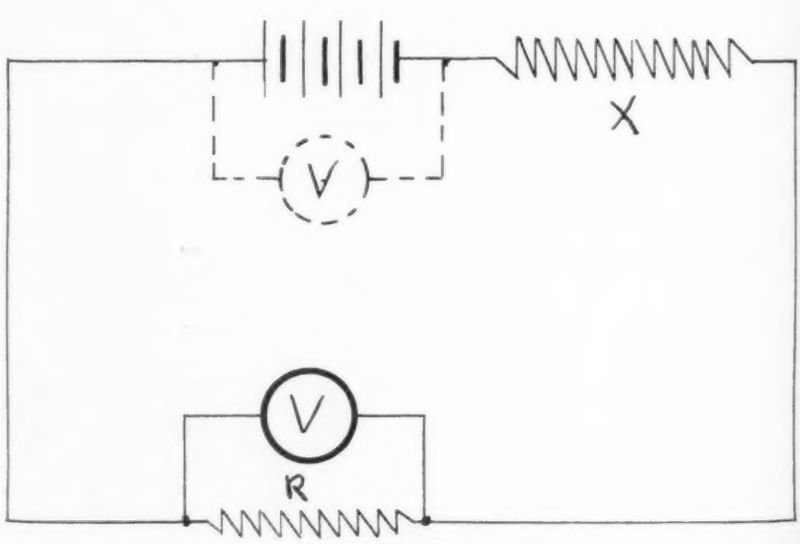


Figure 3

Local Test Desk Operation

(Continued from page 18)

directly proportional to the electric current flowing in amperes, as may be observed from the divisions of the meter scale being so graduated as to being equal to one another.

The movement of the movable coil is due to the dynamic action between the electric current flowing through the coil winding and the magnetic field of the permanent magnet. The pointer becomes stationary and the coil attains a position of equilibruim when the opposing forces of the spiral springs equal the force caused by the rotary tendency of the coil. The well known "dead beat" quality of Weston instruments, that is, whereby the meter pointer or needle comes quickly to rest instead of repeatedly swinging to and fro, is produced by foucault electric currents generated in the rectangular aluminum frame when it is rotating through the magnetic field of the permanent magnet. These foucault currents (sometimes called eddy currents) have sufficient influence on the movement of the meter coil to cause it to come to rest almost instantly.

● The movable coil is generally made only a fraction of an ohm in resistance, and so constructed that it requires only about 0.01 ampere to move the needle across the full scale. In the case of an ammeter, a low resistance shunt is connected in parallel with the coil, so that a greater part of the current value to be measured will flow through the shunt, and only a very small current will pass through the coil.

The resistance of the shunt for any given movable coil and scale reading, may be computed as follows: Assume a coil having resistance of one ohm to be used in an ammeter having a scale value of ten amperes. It is also necessary to know what current through the coil will produce a full scale deflection. In this case it will be considered as 0.01 amperes. By the application of Ohm's Law, the E. M. F. between the meter terminals will be I R or 0.01 $\times 1 = 0.01$ volt.

As this same voltage is impressed across the shunt, then the shunt must be of such a resistance that .01 volt will force 10 minus .01 or 9.99 amperes through it. This resistance must then be .01 divided by 9.99 or .001 ohms.

● Another method of calculating the value of an ammeter shunt is by means of the formula $\frac{A}{N-1}$, where "A" is the resistance of the ammeter and "N" is the constant (that which is not subject to change) of the shunt required and is found by dividing the full scale range of the meter by the value desired. Example: What is the constant of an ammeter having a present range of 0.150 amperes and the desired range is 1.5 amperes?

Solution: $\frac{A}{N-1}$ or $1.5/.150 = 10$.

If the meter resistance is .009 ohm, the value of the new shunt will be $0.009/10\text{-}1 = 0.001$. The ammeter with this new shunt connected across its terminals will give readings which are to be multiplied by 10 to obtain their true value.

In the case of a voltmeter using the coil described above, arranged to measure 100 volts on full scale deflection, a high resistance would be connected in series with the coil so that when an E. M. F. of 100 volts is impressed across the meter including the resistance, a current of only 0.01 amperes would flow through it. The total resistance of the meter would then be $R = \frac{E}{I}$ or $100/.01 = 10000$ ohms. Of this total one ohm is in the coil, so that 9999 ohms must be in the series resistance.

Whenever it is desired to measure higher voltages than that for which a particular voltmeter may be constructed it is accomplished by means of a multiplier. A multiplier is an extra external resistance connected in series with the voltmeter to increase its present range of measurement. The multiplier resistance is calculated as follows: Divide the desired scale value of the meter by its present value, in volts, then multiply the resistance of the voltmeter by this number and subtract from the result the present resistance of the meter. Example: Consider a voltmeter having a range of 0 to 30 volts and a resistance of 10,000 ohms. The desired new range is 0 to 300 volts. This maximum of 300 is divided by 30, giving as its dividend. The present resistance of the meter being 10,000 ohms is multiplied by 10 which equals 100,000 ohms or the total resistance of the whole combination.

● As, however, there is already a resistance of 10,000 ohms in the voltmeter, this is to be subtracted. Therefore, 100,000 minus 10,000 equals 90,000 ohms, the value of the multiplier.

Since a voltmeter operates on such very small current there will be no appreciable fall in the voltage of the source of supply to which the instrument may be connected.

The resistance of the voltmeter is made high, as its purpose is to measure the difference of electrical pressure between the two points to which it is connected. If the meter were low in resistance, it would lower the actual pressure, and an accurate measurement could not be obtained. On the other hand the resistance of the ammeter is made low, as it is placed in series with the circuit whose current value is to be measured, and the ammeter resistance must not increase the total resistance of the circuit by any appreciable

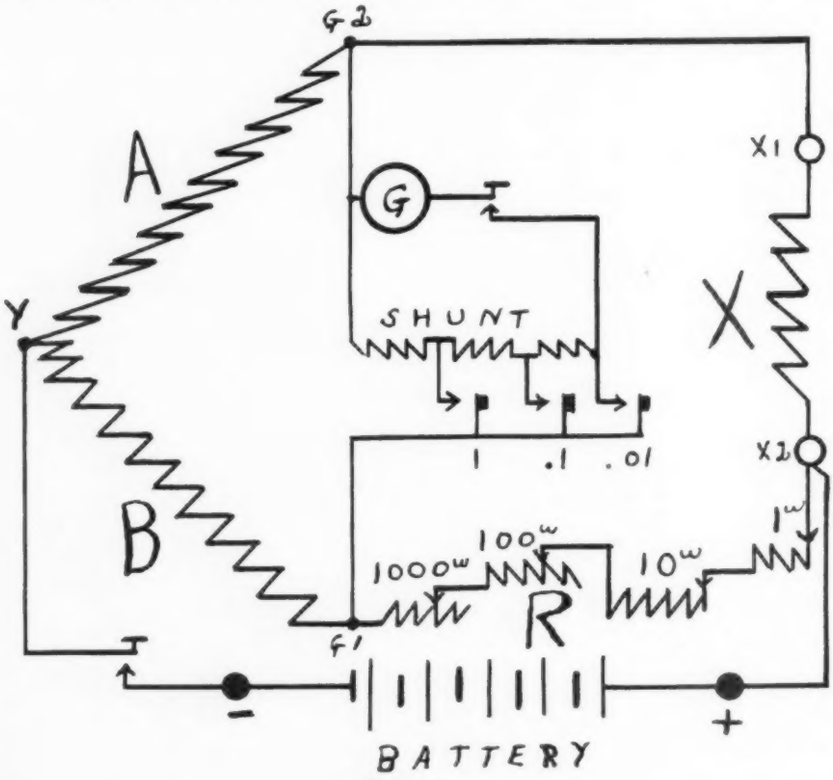


Figure 4

(Please turn to page 30)

Washington and Michigan Associations Hold Meetings

Holding their 22nd annual convention at Edmonds, Wash., June 25 and 26, the Washington Independent Telephone Association re-elected their incumbent officers and added two to their directorate. Those selected were: C. E. Johnston, Interstate Telephone Co., Spokane, and David Burr, of the Lake Washington Telephone Co., Kirland.

President E. R. Hannibal, vice president and general manager of the West Coast Telephone Co., Everett, presided and struck the keynote in his annual address to the association. Important phases including legislation, rural electrification, and impending labor laws. Entertainment was furnished to the convened delegates with the City of Edmonds and D. M. Yost, manager of the Edmonds Independent Telephone Co., and his associates serving as hosts.

Michigan Discusses Rate Increase

Convening at Lansing, Mich., July 28 and 29, the Michigan Independent Telephone Association heard discussion of various important subjects keynoted by a discussion on rate increases by its president, Dr. O. M. Vaughan.

Citing rising costs of materials and equipment together with taxes, federal and state, his address was accepted as voicing the opinion of the entire assemblage.

Officers were re-elected at the closing session and by a change in the by-laws 4 additional directors were selected. Officers re-elected were: President, Dr. Vaughan; vice president, W. J. Melchers, Owosso; and secretary-treasurer, Mrs. Jane Thompson McNally, Lansing.

Directors re-elected were: H. R. Christianson, Muskegon; Chas. W. Cheeney, Cheasaning; B. R. Sage, Central Lake; and P. E. Taylor, Pickford. New directors are: R. C. Smith, Homer; H. S. Bradstreet, Rollin; Ernest Sprague, Lake City; and W. R. Stafford, Port Hope.

Illinois Convention Plans Completed

According to Secretary A. J. Parsons, the Illinois Telephone Association convention slated for September 22-23 at Hotel Pere Marquette, Peoria, will be one that will be of real interest to every telephone man in the industry. The program is in the hands of R. B. Still, R. A. Lumpkin and Lon Jester. This in itself is enough to justify Secretary Parson's statement.

Arrangements for an unusually interesting traffic conference by Mrs. Workman will be of much interest to chief operators and their operators. Entertainment plans have also been made. Exhibitors and their representatives will be there to greet those attending with complete exhibits on the hotel third floor. Indications point to one of the best attended, best planned meeting ever planned by the Illinois association.

FCC Studies Inductive Interference Problem

The controversy between Rural Electrification projects and Independent telephone companies over the problem of inductive interference developed some Washington angles recently. One of the most interesting phases was the filing of a complaint with the FCC by the Gulf Service Co. of Foley, Ala., an Independent, charging that REA inductive interference had disrupted its interstate toll service. As a result the FCC has launched a study of the REA situation and has engaged in discussions with REA offcials.

As a result of complaints about the power interference situation, the Chamber of Commerce of the United States also has started an inquiry into the subject and has conferred with REA officials. However, no decision has resulted from the Chamber's study as yet.

Hill Attacked in Rate Case

Frederic Sammond, attorney for the Wisconsin Telephone company, delivered an attack upon Cyrus C. Hill, former chief accountant for the public service commission, in oral arguments before the commission on the telephone rate reduction case today.

He charged that Hill, who now is with the federal communications commission, was prejudiced and unfair in the rate investigation.

When Fred S. Hunt, commission chairman, said the remarks were not proper in oral arguments, Sammond replied he would have "more violent remarks" to make about Hill when the case goes back to circuit court, to which the company has appealed.

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and

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LINE and DESK

RAY BLAIN, Member A. I. E. E., Editor

Q. We want to connect a short section of 24 ga. cable into a 22 ga. cable for protection between underground and aerial. What location on the pole for placing this cable would you recommend?

A. If this short section of fuse cable must be connected on the pole we would suggest that one splice be on the messenger and the other on the pole. Some trouble has been experienced with this method as the vibration in the span is often concentrated in the short length of 24 ga. cable at the pole causing fatigue of the sheath. We suggest that the short fuse cable be installed in the manhole where the possibility of this trouble is eliminated. This method also saves a splice as one splice would ordinarily be necessary in the manhole anyway and the cutting-in of the 24 ga. cable would require only one additional splice. With this method no splice need ordinarily be made on the pole.

Q. We are contemplating the laying of a steel tape and jute armored lead cable across a pond a distance of about 300 ft. Do you consider this type cable satisfactory for this purpose and can it be drug through the water for this distance satisfactorily?

A. The cable you propose to use will probably be satisfactory for laying across the pond if it has a mud bottom though we suggest that you consult its manufacturer prior to making the installation. We would not approve of the plan of dragging the cable through the water for this distance, as the strain would probably cause mechanical trouble. We would suggest a core hitch well taped to exclude water and then float the cable across the pond. It could be lashed to empty oil drums or cans at about 25 ft. intervals and after it is in place these floats could be removed, permitting the cable to sink to the bottom.

Q. What is considered the average maximum weight for a fully equipped and loaded telephone line construction truck?

A. That would depend entirely on the size, type and equipment of the truck. As an example though one all metal body, fully equipped and loaded with tools and mounted on a two ton chassis weighs approximately 5 tons. This includes pole derrick, winch and all small tools.

Q. In testing cable with gas what is the highest pressure that should be used?

A. Ordinarily the pressure at the admission point should never exceed 50 pounds. This will always permit a much lower pressure at any test point on the cable.

Q. What size of bolt cutters are considered best for general use in the telephone exchange?

A. We prefer two different sizes, a small 14" and a large 24" both equipped with center cut blades. We have found that these sizes best meet the average telephone requirements. The large 36" size is seldom necessary except on heavy construction.

Q. What method is considered best for fastening an extension ladder on the racks of a construction truck to prevent rattling?

A. Some use straps and buckles which is fairly effective though always slow. We believe the best method is to use one of the newly developed spring type ladder clamps which can be purchased at a reasonable cost.

Q. Is it considered necessary to install load coils on the new type buried wire used for rural lines.

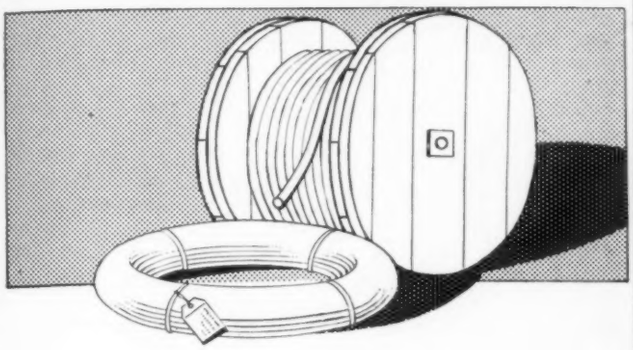
A. This type construction is so new that very little is known of it outside the laboratories. It is understood though that when a buried wire circuit is over five miles in length that loading is provided. A special type load coil, also buried in a weatherproof case is installed about each 8000 ft. It is understood that tests indicated that the 1000 cycle attenuation of the unloaded wire was about 1.1 db per mile and about .49 db per mile on the loaded. It would seem that this proves loading is necessary for this type construction to provide adequate transmission on long circuits.

Q. What is quadded cable, also a composite cable?

A. A quadded cable is one in which some or all of the pairs are separated into groups of two pairs each which are transposed for use with phantom circuits. A composite cable is one in which conductors of different gauges are combined under one lead sheath.

"He's been trying to hit the jack pot all day."

PHILLIPS



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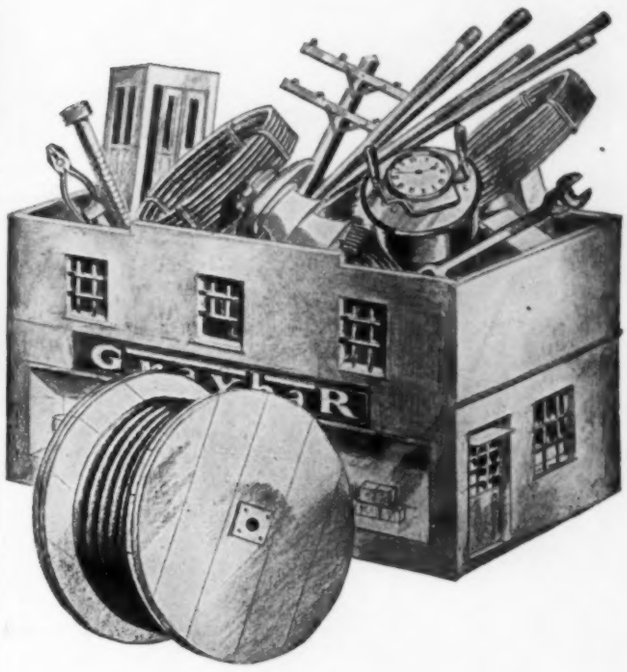

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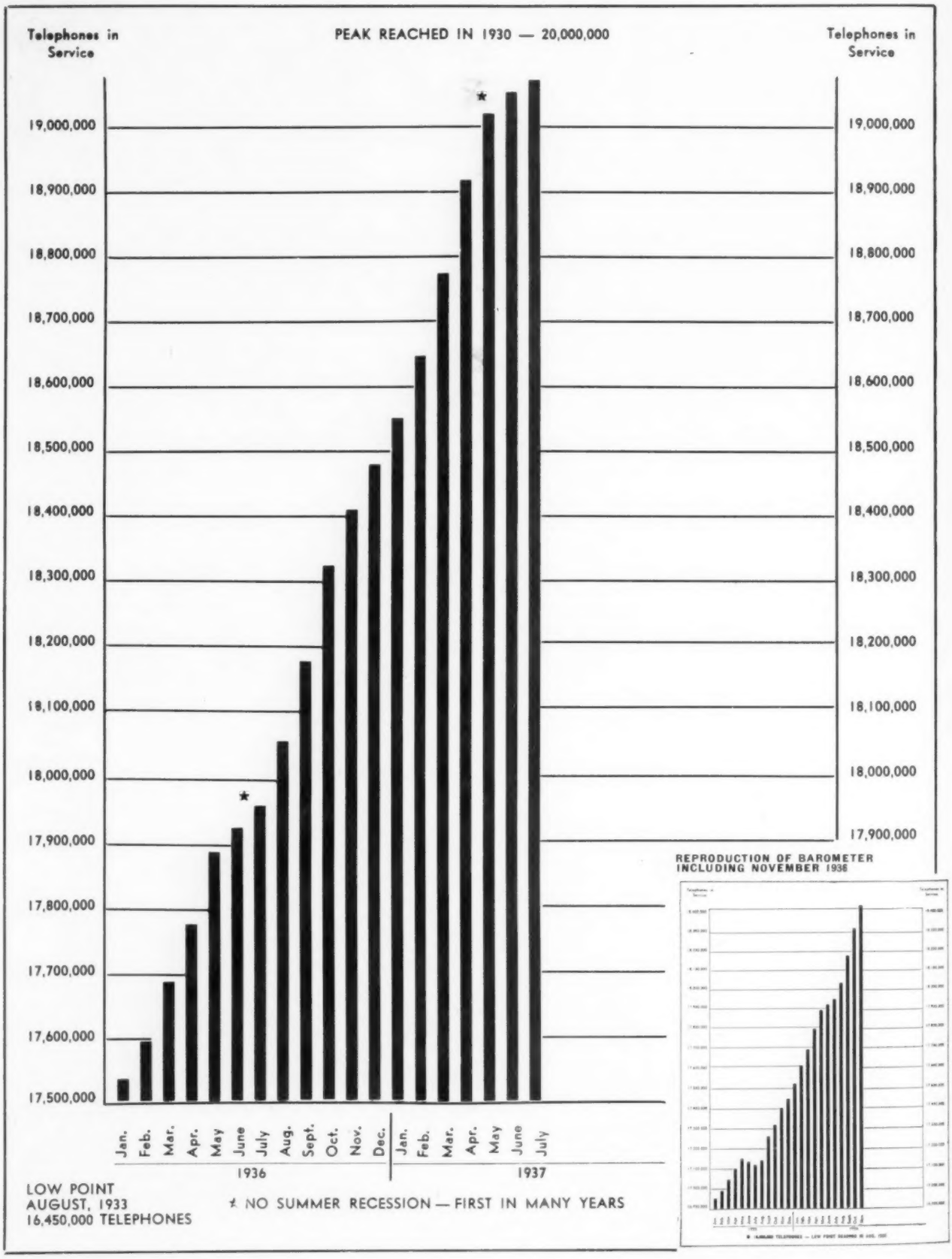

REPRODUCTION OF BAROMETER INCLUDING NOVEMBER 1936

Harvey Lester Harris

HARVEY LESTER HARRIS, executive, engineer, pioneer, and an international figure in the telephone industry, passed away Tuesday evening, August 10, at his home at 179 Lake Shore Drive, Chicago, at the age of 58 years. At the time of his passing he had given 41 years of service to the industry. Although his health had been impaired for several months, he had seemed to be well on the road to recovery when he suffered a relapse. A few days before his death he had a stroke and fell into a coma from which he did not recover.

Mr. Harris' death robs the telephone business of one of its most vigorous and influential leaders—one who has left an indelible impression on the history of telephone progress. While known chiefly through his official connections with the Gary group of telephone enterprises, he was also active in association work, and was a familiar figure wherever telephone men — manufacturers or operating people—gathered to discuss mutual problems. At the time of his death, he was president of Associated Telephone and Telegraph Company, Automatic Electric Company and American Automatic Electric Sales Company, Automatic Electric Sales Co., Ltd., all of Chicago, and president of Phillips Electrical Works, Limited, Brockville, Ontario, and Canadian Telephones and Supplies, Limited, Toronto. In addition, he held office or was a director in many other companies of the Gary group.

Mr. Harris was born at Presque Isle, Maine, in 1879, son of William H. and Georgia (Lovely) Harris. He received his early training partly in the public schools of Maine, and partly in Ohio to which state his family moved while he was still a boy. While at Painesville, Ohio, he augmented his public school training by university extension courses. His first contact with the telephone business took place during high school days, when he worked after school hours and on Sundays and holidays as trouble shooter and night operator for the Painesville exchange of the Central Union Telephone Company.

After leaving high school, 1896, he began his real telephone career literally on the ground, when he went to work as groundman in a construction gang which was building a competing plant for the Home Telephone Company at Painesville. He then returned to the Central Union company, afterwards becoming associated in succession with the Cleveland Telephone Company, the Sandusky Telephone Company, and the Cuyahoga Telephone Company, and its parent organization, the United States Telephone Company, of Cleveland. By this time, Mr. Harris had risen in the ranks to the position of assistant superintendent of equipment, and his varied experience with these organizations gave him a sound, practical background which was destined to stand him in good stead in later years when his duties began to assume executive importance.

In 1907, Mr. Harris entered the engineering department of the Dean Electric Company (later the Garford Manufacturing Company), of Elyria, Ohio. He was soon transferred to the sales engineering department of that company where he was assigned to the job of estimating and designing of large multiple switchboards. He was one of the group of pioneer engineers of the Dean company who

(Continued on page 35)

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Location of Cable Faults

(Continued from page 15)

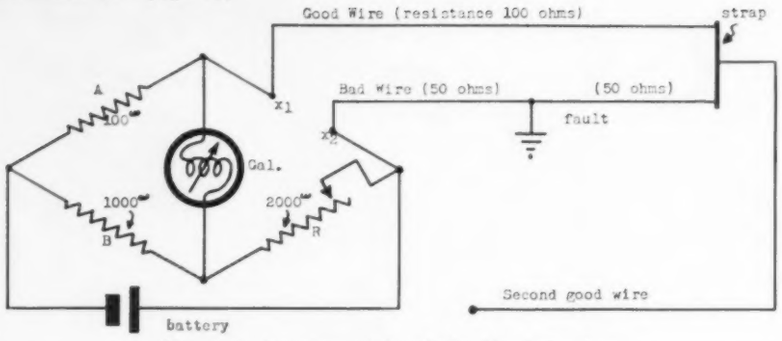

Figure 7—Arrangement for Varley No. 3 Reading

The resistance of the bad wire from strap to fault and bridge to fault should check with the known overall resistance of the bad wire. The distance from fault to strap is obtained in the same manner as explained under the simple Varley method.

●The following example (See Figures 6-7-8) illustrates the application of the three test Varley method as applied to the location of a fault in 22 gauge cable. Readings obtained on the three tests are—R_1= 900 ohms, R_2=1450 ohms, R_3=200W.

The resistance from strap to fault would be—

X^b=.091 (R_2—R_1)=.091 (1450—900 =50 ohms.

The resistance from bridge to fault would be—

X_a=.091 (R_3—R_2=.091 (2000—1450=50 ohms.

The distance from strap to fault would be—

50.00×61.95=3097.5 feet.

Correcting Readings for Temperatures Above or Below 68° F.

● The table giving feet per ohm and ohms per 1000 feet for 24, 22, and 19 cable is precise only for temperatures of 68° Fahrenheit. The resistance of copper wire increases as the temperature increases.

When measuring cable or open wire and the temperature is higher than 68° F, the feet per ohm values must be corrected for the true temperature. The formula for correcting the temperatures is as follows:

Where Actual Temperature Is Above 68° F.

● Ft. per ohm minus (C×0.00218× ft. per ohm at 68°)=True ft. per ohm for actual temperature.

Where Actual Temperature Is Less Than 68° F.

Ft. per ohm plus (C× .00218 × ft. per ohm at 68°)= True ft. per ohm for actual temperature.

Note: C is difference in degrees between actual temperature and 68°.

To illustrate how this correction formula would be used, assume we are making a measurement on a cable where the temperature is 90° F, what will be the actual feet per ohm for 24 gauge cable at this temperature?

Step 1. C=90°–68°=22°

Step 2. 38.96—(22×.00218×38.96)= 37.09 ft. per ohm at 90°.

Miscellaneous Notes on Cable Fault Location

● Note 1. In making three Varley fault location tests it may be found that it is impossible to balance the bridge on the Varley No. 1 test if the resistance of the good wire from bridge to strap is more than 1100 ohms (when ratio arm is set on 0.1). The reason for this is apparent by recognizing that with the ratio dial set on 0.1, we must have 10 times as much resistance cut into the R arm as we have in the X arm. Hence with 1100 ohms in the X arm, the R arm would need to be

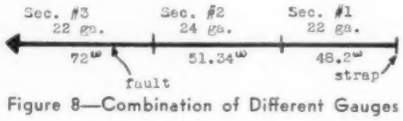

Figure 8—Combination of Different Gauges

set on 11,000 ohms less the resistance of the bad wire. Inasmuch as the rheostat arm in the average bridge has a range of only 9,999 ohms it is apparent that with good wire resistances greater than 1100 ohms we could not get a balance.

In order to get a balance we must therefore change the setting of our ratio arm to 1.0. Under this setting we will get a reading in ohms which is equal to the difference in resistance of bad and good wires. If it should happen that the resistance of the bad wire is higher than that of the good wire, we would be unable to get the bridge to balance. In this case a fixed resistance should be inserted in series with the good wire (this is the wire which connects to the X_1 post of the bridge). The value of this resistance is not important, just so it is high enough to increase the total resistance of the good wire to a value higher than that of the bad wire.

All three Varley readings must be made with the same ratio dial (A/B arm) setting otherwise the computations will be grossly in error.

● Note 2. If the section of cable between strap and fault contains several different gauge cables, care must be exercised in converting the "ohms to fault" computation into "feet to fault." This is best accomplished by computing the resistance of each section of a given gauge. After the resistance to the fault has been computed, subtract the separate resistance of each section of cable (starting from the strap) from the resistance to the fault. This will readily show in which section of cable the fault lies. The distance from the start of this section to the fault is then computed by the method previously described.

The following example illustrates how this method is used.

Referring to Figure 8, it will be seen that three sections of cable are shown being 22, 24, and 22 gauge, respectively.

The measured resistance from strap to fault is found to be 130 ohms.

Step 1. Subtracting to find in which section the fault lies.

130.00 Resistance from strap to fault.
48.42 Resistance of Section No. 1.
81.58 Remainder.
51.34 Resistance of Section No. 2.
30.24 Remainder (shows the fault lies in Section No. 3.

Step No. 2. Computing distance to fault.

30.24×61.95 (ft. per ohm for 22 ga.)= 2126.12 ft. to fault from end of Section 3.

Note No. 3. In the location of Cable faults on multiple cables the fault may lie in a branch cable whereas the strap between good and bad wire is placed on the main cable.

● The bridge measurement will in such cases show that the fault lies at the junction at which the branch cable breaks off from the branch cable.

In such cases the strap should be moved to the branch cable and a new measurement made.

Likewise if the strap is not placed beyond the fault, the bridge location will show that the fault is located at the point at which the strap is applied.

Note No. 4. In testing for shorts or crosses one of the crossed or shorted wires is treated the same as is the ground connection in the case of a ground fault.

Note No. 5. In testing for cable trouble in buried or U. G. cable in which a precise location is desired, the strap should be applied first as close to the section of cable in which the fault is known to exist as possible. If there is no nearby terminals, it may be desirable to "blow" a sleeve and apply the strap on a cable pair selected in the blown sleeve.

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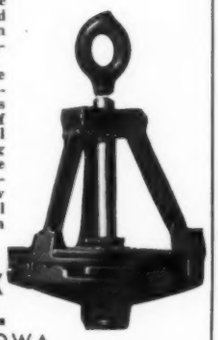

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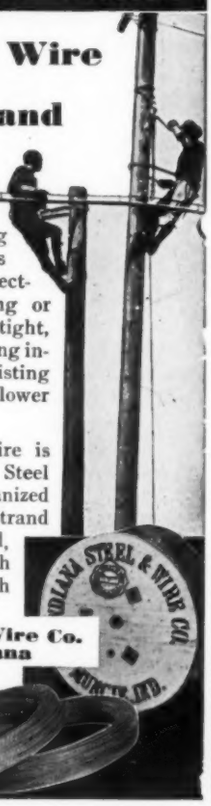

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Indiana Steel & Wire Co.
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●If it is necessary to open pavement to get to the trouble in an underground cable, the trouble location should be double checked. This is of course done by the three Varley method which gives resistance to fault from strap and from the bridge. These two measurements should check with the overall resistance of the bad wire.

It is often a good idea to move the bridge out to the strap and measure from this end of the cable toward the office. In this case Varley No. 3 reading would be the most accurate reading provided the bridge is close to the fault location.

Note No. 6. To obtain proficiency and confidence in the use of the Wheatstone Bridge, test faults should be established and measured and then checked against the known location of the fault. Test faults can be established by connecting a high resistance radio 1 watt type resistor from one side of a circuit to ground in any multiple cable terminal. By using resistances of various values the limitations of the bridge can be readily determined.

● Suggested values for test resistors would be 100w, 10,000w, 50,000w and 100,000w ohms. The higher the value of the resistance which is used as a fault the greater will be the difficulty in telling when the bridge is balanced. The current flowing through the several arms of the bridge must flow through the fault resistance, hence is greatly attenuated with high resistance. When testing for high resistance faults, increase the voltage of the bridge test battery to as high as 100 volts.

If your measurements are carefully made you will find that the value of the fault resistance does not affect the accuracy of the measurement.

New York Fair Signs First Lease

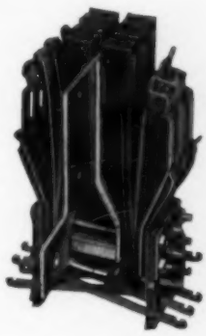
Carrying out its theme "Building the World of Tomorrow", the New York World's Fair of 1939 will unfold a graphic story of progress in many lines of science and industry.

This was emphasized recently on the occasion of the signing of the first lease for exhibit space. This contract was executed by President Walter S. Gifford of the American Telephone and Telegraph Company and President Grover Whalen of the Fair organization. It calls for three and one-fifth acres of building space on the main axis of the Exposition grounds, near Flushing, L. I. There the Bell System building and displays portraying progress in the communication field will be a major feature of the Fair.

Following completition of the structure and the installation of the displays, the exhibit will be managed by the New York Telephone Company.

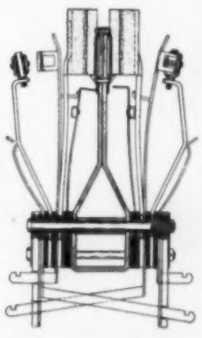
COOK

No. 3800
Central Office Protector



The Cook No. 3800 Central Office Protector is our latest design. It includes the ratchet type self-soldering coil, alarm circuit and cut-over and test springs. This protector operates to open the circuit and ground the line.

It is built in 51 and 101 pair sections. The pairs being spaced on 3/8" centers, give great economy in head-room.



COOK ELECTRIC CO.
2700 Southport Ave. Chicago

Always Specify
COOK
PROTECTION

Local Test Desk Operation

(Continued from page 22)

amount, or accurate measurements cannot be obtained.

A milliammeter is simply a sensitive ammeter constructed so as to measure in thousandths of an ampere instead of in amperes. A millivoltmeter reads in thousandths of a volt.

Figure 2 shows the relative position of a voltmeter and ammeter in a circuit. The voltmeter is bridged across, that is, connected in parallel with the part of the circuit "Y" and "Z" whose E. M. F. or voltage is required while the ammeter is connected in series in order that the current in the circuit will flow through it. This method of using these two instruments places a definite restriction upon the construction of each if accurate results are to be obtained.

● Since the voltmeter is connected across the circuit, the amount of current taken through it must be small, otherwise there would be a greater drop of voltage in "R" than would be caused by the current actually flowing to resistance "X". The current taken by the voltmeter can be kept small by making the voltmeter resistance high in proportion to the voltage being measured. Likewise the resistance of the ammeter must be small in order that the current which is flowing in the circuit will not be materially reduced when the meter is connected. To measure a resistance with an ammeter it is necessary to connect the ammeter in series with the resistance to be measured and the battery of known E. M. F. The resistance may then be determined by Ohm's law in which $R=\frac{E}{I}$.

Another way to obtain the value of an unknown resistance is by means of the drop of voltage method in which a voltmeter and a resistance of known value are used and connected as shown in figure 3. The voltmeter is first connected across the battery as shown in dotted lines and then across the known resistance "R."

The unknown resistance can now be obtained by the formula $X=\frac{E-V}{V}R$, where

E=Testing battery voltage.
V=Drop in voltage at known resistance.
R=Known resistance, and
X=Unknown resistance.

Applying to figure 3, $X=\frac{E-V}{V}R$, or $30-12=18/12=1.5\times200=300$ ohms.

● When reading test desk voltmeters, milliammeters and etc., care should be taken to guard against errors due to the angle of observation usually referred to as parallax, that is, the apparent change in position of an object when looked at from two points of view. By looking at an object a few feet distant first with one eye and then with the other, the shifting in apparent position is seen.

In reading the position of a pointer over a meter scale parallax introduces an error unless the eye is held directly over the pointer. The percentage of error can be greatly reduced by keeping the eye in direct line with the pointer and its reflection in the mirror located directly below the pointer, that is, if the instrument is equipped with a mirror, otherwise in line with pointer.

Allowing too great a current to flow through a voltmeter, or connecting it to a higher E. M. F. than that for which it is built should be avoided. Care should also be taken that the test desk meters are not subjected to sudden jars, or excessive vibration, or otherwise roughly handled as this may injure the instrument and destroy its sensitiveness.

The power in any part of a direct current circuit may be determined by measuring the current by means of an ammeter connected in series with the circuit and a voltmeter across the terminals of the portion of the circuit in which it is desired to ascertain the power value, that is, to measure the power or watts being delivered by any source of electromotive force, it is necessary to measure the voltage and current.

In cases where it is considered necessary to frequently measure the power in a circuit, a specially constructed instrument called a wattmeter is used, in which, instead of having permanent magnets to produce a magnetic field, a stationary coil is connected across a shunt which is in turn connected in series with the circuit. The strength of the magnetic field produced in this coil varies with the amount of current flowing in the circuit.

● Another coil known as a voltage coil is so connected that any magnetic lines of force produced by it will tend to turn the coil so that these magnetic lines of force will be parallel with those produced by the current coil.

This voltage coil is connected through a high resistance across the circuit, consequently, the resulting deflection of the pointer over the calibrated scale of the meter is due to the combined effect of both the current and voltage existing in the circuit, that is, the instrument is so designed that the pointer deflection is proportional to the product of the current and voltage, or in other words, so that it indicates directly in watts.

To measure electrical resistance with extreme accuracy, the electric balance or Wheatstone bridge, is universally used in telephone testing practices. Figure 4 represents the schematic circuit

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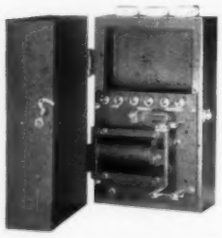
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(See our space in next month's issue)

arrangement of the Leeds and Northrup Company Wheatstone bridge testing sets Nos. 5300 and 5430.

In this apparatus a dry cell battery of the desired voltage is connected to points (—) and (+) of a circuit that consists of conductors A, B, R, and X, and are the arms of the bridge. Between points G 1 and G 2, a sensitive galvanometer and its associated shunt is connected. Keys are inserted in the galvanometer circuit and also in the circuit between the negative pole of the battery and point "Y", as well as in series with the galvanometer "G". The A and B arms are called the ratio arms.

● To the arm "R" is connected a rheostat consisting of four variable resistances operated by means of dials, and applicable to units, tens, hundreds, and thousand also to tenths, hundredths, thousandths, and ten-thousandths. To the "X" arm at point X_1 and X_2, is connected the unknown resistance to be measured.

The operation of the bridge is dependent upon the following principle: The passage of an electric current through any circuit is attended by a drop in voltage in that circuit, that is proportional to its resistance and the amount of current flowing. Consequently, if the resistance in arms A, R, and B, are so proportioned to the value of the unknown resistance "X", that the voltage drop is such that no current flows through the galvanometer "G" then it can be demonstrated that the resistance in arm "A" is to the resistance in "R" as the resistance in "B" is to the resistance in "X", that is, the value of the resistance "X" is equal to the value of the resistance in "B" multiplied by the resistance in "R" divided by the resistance in "A". The formula for this is $X = \frac{BR}{A}$

In measuring a high resistance with the bridge, it is necessary that the value of the resistance in the arm "A" should be low, since from the formula $X=\frac{BR}{A}$ it will be observed that the value of the resistance in the arm "A" is the divisor, therefore, if a low resistance is selected for it and a high resistance for the "B" arm, the quotion will be high. For example, let "B" equal 100 ohms, and "A" 1 ohm, and if a balance against an unknown resistance is obtained when 300 ohms is inserted in the rheostat "R", then according to the formula $X = \frac{BR}{A}$ or $100 \times 300/1 = 30000$ ohms.

In the case of measuring a low resistance, the arm "A" should have a high resistance and arm "B" a small resistance. For example, let arm "A" equal 100 ohms and "B" 10 ohms, and balance obtained with 4 ohms in the rheostat "R" then $X = \frac{BR}{A}$ or $10 \times 4/100 = 0.4$ ohms.

● In the L&N Wheatstone bridge, referred to above, the A and B arms are contained in a single movable dial so designed that all it is required is to set the dial to multiply the value in the rheostat directly by .001, .01, .1, 1, 10, 100, or 1000. The formula as given for this type bridge arrangement is $X=\frac{A}{B}R$, in which the value of $\frac{A}{B}$ is obtained by setting the single ratio dial on any of the points .001, etc. listed above.

TO BE CONTINUED

Reuben Davis Ends Career

Reuben Davis, who since 1916 served the Stromberg-Carlson Telephone Mfg. Co., passed away at his home in Philadelphia on July 10th, following a long illness. Mr. Davis directed the sales activities of the Stromberg-Carlson Co. in Pennsylvania and New Jersey for many years up to the time of his death.

Born April 25, 1873, in Elizabeth City, North Carolina, he spent his boyhood in that town,, attending the public schools and later graduating from the Elizabeth City Academy. Post-graduate work followed when he finished at the Academy before entering the field of telephone service to the public. The Elizabeth City Electric Co., with whom he became associated, made Mr. Davis the manager of their organization. Later he left to become manager of the Charleston, West Virginia Telephone Co. Leaving the operating field, Mr. Davis became affiliated with the North Electric Co. of Cleveland and later the Dean Electric Co. of Elyria, Ohio. He joined the Stromberg-Carlson sales staff in July, 1916 when the Garford Mfg. Co., successor to the Dean Electric Co., was absorbed by the Stromberg-Carlson Telephone Mfg. Co. of Rochester, N. Y. In November of 1928 he entered the radio business with Cliff Hunt in Philadelphia, forming the firm of Davis-Hunt, Inc. He was also engaged in this business until February, 1935 when the company was dissolved.

In his passing, Mr. Davis leaves a host of friends, and the Stromberg-Carlson Company loses a loyal personality, who for the twenty-one years of his association with the firm was one of their heaviest producers.

He is survived by his wife, one daughter, and two sons.

New A. T. & T. Director

Clay Williams, of Winston-Salem, N. C., today was elected a director of American Telephone & Telegraph Co., succeeding the late George F. Baker.

Williamsport STRAND

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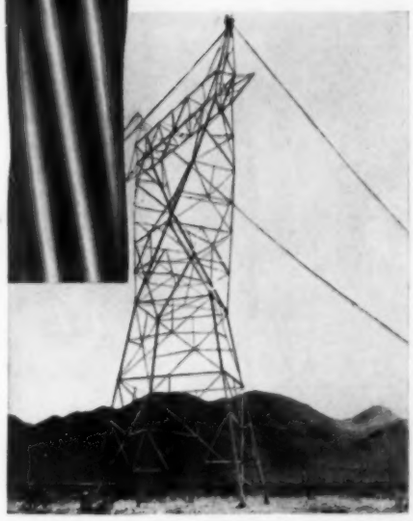

Williamsport strands are the product of nearly half a century of exclusive wire rope manufacture. Many of the Williamsport men have been with the company since its first few years. They know their job. They like it. And are devoting their best efforts to turning out a powerful, weather-, corrosion- and strain-resisting strand. Write "Williamsport" on your next strand order and watch the strand replacement costs go down!

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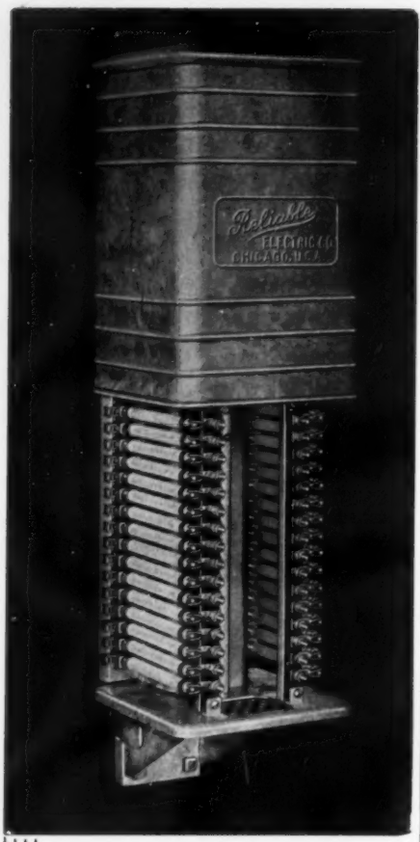

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Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
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"Tapping In" On Washington

(Continued from page 14)

year before placed in public operation, will be described in further detail in another hearing before the Division Sept. 8.

At the same time, two expert engineers of the American Telephone and Telegraph Co., Frank A. Cowan, Long Lines Transmission Engineer, and Frank Bown, radio research director of the Bell Telephone Laboratories, informed the FCC about some new radiotelephone technical developments, devised by the A.T.&T., which are expected to greatly improve the efficiency of the transoceanic radiotelephone service but also will enlarge considerably the capacity of radiotelephone channels in the present frequencies. The increasing of the capacity of the frequencies is regarded as a notable forward step as the radio ether is now becoming so overcrowded that Federal Government authorities have been concerned that the growth of radio services may receive a distinct barrier due to the lack of channel space.

● The two major developments of the A.T.&T. in this field are the achievement of single sideband transmission and the securing of a greatly increased directivity through a new antenna system. The single sideband transmission cuts the frequency space per channel by one-half so that two telephone channels exist where one was usable previously. Power is increased four fold and the signal to noise ratio at the receiver is doubled so that greater accuracy and efficiency of service is obtainable. The new antenna system is called the MUSA system after the initial letters of the descriptive title of the system, multiple unit steerable antenna and is comprised of a number of horizontal rhombic antennas laid end to end in the direction of the incoming signals. This system, according to tests, has greatly increased directivity and reduced noise. Through the rhombic antenna setup all the components of the radio signal are received from all normal angles and are combined through multiple receiving units into the complete signals. Another development in the offing, which was indicated, was that privacy in radiotelephony in the future through single sideband transmission would be obtained by band splitting synchronously switching instead of the inversion wobbled carrier type, the former consisting of changing the band of combined frequencies several times a minute.

The A.T.&T. reported that the present volume of transatlantic radiotelephone traffic has reached a point where additional facilities may be needed to care for the fast-growing public demand. The present traffic averages 115 messages per business day between New York and London and Paris, while the estimated capacity is 140 messages. The volume of traffic increased about 100 per cent in 1936 over previous years and for the first six months of 1937 there was a gain of 50 per cent or more for every leading nation of the world in this traffic. As a result the service, although still running with expenses greater than revenues, gives promise of being placed on a profitable basis in the near future.

Labor Unions Organizing Independents . . .

● The labor front for the telephone industry was quiet during the last month in distinct comparison to the embattled situation of union organizing campaigns in many other industries. The aroused public reaction to the violence and other events in the steel strikes especially was reported to have retarded the A. F. of L. and C.I.O. campaigns in some sections of the country, particularly New England and the South, but on the whole the unions reported that their enrollment of new industries and workers was proceeding satisfactorily.

The union successes in the telephone field were rather minor, but organization of workers in four Independent companies which comprised in two cases collective bargaining proceedings before the National Labor Relations Board, was reported. These companies included the Warren, O. Telephone Co., where the A. F. of L. was victorious, the Portsmouth, O. Home Telephone Co., which was organized by the C.I.O. because of the dominant position of the C.I.O. in that southern Ohio city, the Dover, O. Telephone Co. and the West Coast Telephone Co. in Spokane, Wash. Up to the present the Bell System employees appear to prefer to an overwhelming degree their own independent company-wide employees' associations and in one Bell System company, the Chesapeake and Potomac of Virginia, the management recognized formally the employees' association as the collective bargaining agency. The Stromberg-Carlson Telephone Manufacturing Co., an Independent telephone and radio manufacturer, also had a majority of employees who desired an independent organization rather than affiliation with the labor union groups.

Bell Installations For July

The American Telephone and Telegraph company reported today a net gain of 22,600 telephones in service in the principal telephone subsidiaries of the Bell System during July, compared with a net gain of 27,500 instruments in the same month last year.

Live luxuriously at the Commonwealth hotel

Cheerful
Convenient
Comfortable

Just 10 Minutes to the Loop

SPECIAL RATES FOR ALL TRADE SHOWS AND CONVENTIONS

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All Chance Expanding and Cone Anchors have the Chance patented nut retainer or nut housing.

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The MASTER Ringing Converter

NO MOVING PARTS!

- No Vibrating Contacts
- No Adjustments
- No Rectifiers
- No Radio Interference
- Reverting Tone Feature

Output 20 Watts, 90 Volts Operates on 110 Volts A. C.

PRICE, $45.00

Equipt with Pulsator for Biased Ringing $55.00

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The four pamphlets listed below will be sent without charge to anyone interested. Check the ones you want:

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3200 BELMONT AVENUE

Install Telephones and Amplifiers in Schools

With installation of a telephone and a loud speaker in each of its 69 rooms of the senior high, the Appleton, Wis., school children will now be able to hear addresses by their principal or other speakers without moving from their desks. Microphones are at different parts of the building.

Citing the telephone installations as an administative necessity and the loud speaking system as an instructional device, the success of the plan opens a broad field for installations by companies who have not considered this outlet for their services. A switchboard handles the entire system and is operated manually. Serving as an attendance check and a method of relaying instructions simultaneously, the system is proving indispensible.

Stromberg-Carlson Personnel Changes

Appointment of Alfred S. Jackson, Rochester, N. Y., as sales representative for the Stromberg-Carlson Telephone Manufacturing Co., to cover the area of Pennsylvania, Virginia, New Jersey, Delaware, Maryland and the District of Columbia, has just been announced by Ben Woodbury, sales manager of the firm.

With a background including service with Empire State Railways as electrical inspector; thence with Western Electric as an installation engineer; his service with Stromberg-Carlson started as Installation Foreman. During his 13 years with the company he was responsible for installing complete central office equipment throughout the East, South and Middle West. In February, 1936, he left to join the Rochester Telephone Corp but has now resumed his association as of August 2.

Succeeding to the post left vacant by the late Charles Boberg, appointment has just been announced of the selection of Colby Knapp as cashier and credit manager of Stromberg-Carlson's Chicago Division. In making this selection, A. F. Gibson, credit manager of the company's head office at Rochester, took Mr. Knapp from the sales department where he served as representative in the Indiana territory.

Pete Winemiller, well known sales engineer of Stromberg-Carlson's Chicago office will take Knapp's place as telephone sales representative in Indiana.

Charles Porter Boberg

January 2, 1887 — June 24, 1937

With the passing of Mr. Charles P. Boberg on June 24, 1937 Stromberg-Carlson Telephone Manufacturing Company lost one of its most faithful employees.

In June 1903 Mr. Boberg became connected with the company as Cashier of the Chicago Division and since that time has discharged his duties with zeal and earnestness to the entire satisfaction of his company and its customers. He endeared himself to all with whom he was associated. He had been in poor health for several months but was able to come to work almost regularly until the day of his death. His passing was indeed a severe shock to his co-workers and friends.

His wife, Mrs. Anastasia Becker Boberg, preceded him in death in 1934. He is survived by two children, Charles

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Neither quality nor strength have been sacrificed—in fact we have strengthened our anchors so as to give them still greater holding power.

We show our appreciation with a price reduction and thank you most sincerely.

Aiken Mastergrip Anchor Co., Inc.
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114 NORTH 7TH ST., ST. LOUIS

ORDER THROUGH YOUR SUPPLIER

Junior, twenty-two years of age and Blanche, eighteen years of age.

He was active in fraternal groups, being an honorary member of the South Side Swedish Club and a member of Auburn Park Lodge No. 729, A. F. & A. M. Funeral services were held in the Stephens Funeral Home and interment was made in Oak Wood Cemetery.

Sturgis Develops New Operator's Chair

Completion of a new model operators chair has just been announced by the Sturgis Posture Chair Company. Specifications include 9"x13" form fitting plaited back and cane bottom seat 14" by 16" wide. Upholstery for back available in leather or frieze fabric.

Adjustable by hand, the back is easily fitted to individual taste. A seat height of 22 to 26 inches with circular footrest 12" from floor is raised 2 inches if casters are specified instead of regular rubber cushion glides. Name plate on back.

Harvey Lester Harris

(Continued from page 27)

in later years rose to high place in the telephone industry and contributed so much to the technical accomplishments of the Independent group. Mr. Harris himself attained a reputation while with the Dean company of being one of the most capable circuit engineers in the entire industry.

When the Garford Manufacturing Company was sold to the Stromberg Carlson organization in 1916, Mr. Harris continued with the latter organization as general sales engineer.

In October 1917, he resigned from Stromberg-Carlson to accept an appointment with the Theodore Gary interests, with which he remained closely identified until his death. His first appointment in this group was as secretary and general manager of the Kansas City Home Telephone Company; later, he assumed similar posts with the Kansas City Long Distance Telephone Company, and other operating subsidiaries of the group.

As general manager of the Kansas City Home Telephone Company, he was one of the group who developed merger plans for the unification of the Bell and Home plants in Kansas City. Upon completion of the merger, he became secretary and general manager of the unified property—the Kansas City Telephone Company. In 1920, he became director, and vice president and executive officer of Theodore Gary and Company, and held office also in many of their operating subsidiaries.

In 1921, two years after the Gary organization had acquired Automatic Electric Company, Mr. Harris was appointed to the management committee of that company. In 1923, he was made vice-president, thereafter dividing his time between Kansas City and Chicago, while still retaining his various connections with the Kansas City organization.

In the spring of 1925, Mr. Harris became executive vice-president of the Automatic company in full charge of all operations, including manufacture, development and promotion. In January, 1927, he was made president, retiring one year later to assume general executive direction of all the manufacturing and sales companies, both domestic and foreign, of the Gary group. These activities were headed up by Associated Telephone and Telegraph Company, of which he became executive vice-president, and, in 1936, president.

During the middle twenties, Mr. Harris was particularly active in the development of the company's foreign business, including the acquisition of concessions,

(Continued on page 36)

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Tree Trimming Tools

No. 777 Two Hand Pruner
Drop forged tool steel. Rapid cutter. Blade may be placed next to main limb of tree with hook handle held in LEFT hand. Right hand is FREE to operate blade. 26" handles.

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Most powerful compound lever Tree Trimmer made. Will easily sever branches up to 1¼" diam. Pulley and **compound lever** give 9 to 1 cutting power. Head complete weighs only 1¾ lbs. 4 to 16 ft. lengths. Other types.

No. 43 and 44 Pole Saws
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sales negotiations, etc. His work required his spending considerable time abroad. He traveled extensively in Europe and in Central and South America, and became well known among telephone men in those parts of the world.

These many activities represent little more than highlights in Mr. Harris' history, and they fall far short of doing justice to his capacity for handling large and important assignments. But the many official positions he had held tell the story of a broad-gauged, large-visioned, untiring man of affairs. His enthusiasm for long hours of hard work was a byword among those who knew him best. In spite of the enormous amount of detail that necessarily passed through his hands, his judgment was excellent, and he had the faculty of grasping the essentials of a situation quickly, and following with a prompt and sound decision.

In business, as well as during those rare times when he was away from it, Mr. Harris displayed a singularly likeable personality. Sincerity and friendliness were among his strongest attributes. As a result he made many friends, not only among telephone men in the United States, but wherever he traveled throughout the world. Literally hundreds of men will miss greatly his enthusiasm, his energy, and his friendly counsel.

In spite of his untiring zeal and his rise to high places in the telephone field, Mr. Harris never lost personal and friendly interest in the individuals who came under his supervision. While he was exacting in his demands, few men were ever served more willingly or were accorded greater respect or more thorough cooperation. It would be hard to imagine a more exacting test for genius in management.

Mr. Harris' activities in connection with telephone association work began in 1919, when he was elected a member of the executive committee of the Kansas Telephone Association. In May, 1921, he was elected to the board of directors of the United States Independent Telephone Association, and in November of the following year, he was appointed a member of the executive committee of that body. He was also a member of the board of governors of the National Electrical Manufacturers' Association, a member of the American Institute of Electrical Engineers, Western Society of Engineers, Chicago Association of Commerce, United States Chamber of Commerce and the Pan-American Society.

Clubs and fraternal organizations figured largely in Mr. Harris' social activities. He held memberships in the Chicago Athletic Club, the South Shore Country Club and the Mid-Day Club (all of Chicago); the Bankers' Club and Uptown Club (both of New York) and the Kansas City Club. He was a member also of the Ararat Shrine, the Elks, and all the Masonic bodies, York and Scottish Rites, in Kansas City.

Mr. Harris is survived by Mrs. Harris, (nee Cora Plough) whom he married in 1916, and who was his constant and helpful companion throughout both his social and business career. Also surviving are two children, of an earlier marriage, Lionel R. and Rhea M., both of Elyria, Ohio.

Funeral services, which were held in the chapel at Oakwoods Cemetery, Chicago, on Thursday, August 12, at 3 p. m., were attended by a large number of friends and associates, many of them from out of town. Others, unable to attend in person, sent floral tributes as an expression of their respect, and of their sympathy for the bereaved family.

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Manager Promoted

F. H. Edminster, for the last four years manager of the LeMars (Iowa) telephone exchange, has been promoted to purchasing agent for the Central Electric & Telephone Co. and its subsidiaries. Edminster will be succeeded as manager of the LeMars exchange by Harold R. Bollinger, formerly of St. Paul, Minn.

Fortner Is Union Chief

Leading in the move now under way to transfer about 18,000 Southwestern Bell Telephone Co. employees from the Bell Telephone Employees association to a new organization, the Southwestern Telephone Workers union, is Arthur H. Fortner, 34-year-old Oklahoma City man.

Fortner, a local testboard man in the Oklahoma City office of the company, an l chairman of the union's board of directors, said the action is being undertaken in accordance with the recently-validated Wagner labor relations act.

In voting on the change, individual employes would agree to create the new union and "to grant your representative sole bargaining power and also authority to dissolve the B. T. E. A. and the S. T. W. U."

Fortner said the entire vote among employes in five states may be completed in the near future.

Net Operating Income Rising

Federal communications commission reports that eighty-one large telephone companies had a combined net operating income in March of $20,043,358 against $19,490,449 in March, 1935. For the first three months of 1937, combined net operating income was $59,-890,066, against $55,174,635 in the 1936 period.

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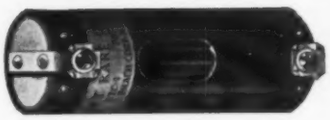

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